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CROWELL & MORING LLP
INTELLECTUAL PROPERTY GROUP
P.O. BOX 14300
WASHINGTON, DC 20044-4300

EXAMINER	
CANTELMO, GREGG	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/484,421	DUBS ET AL.	
	Examiner	Art Unit	
	Gregg Cantelmo	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 December 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *17-59* is/are pending in the application.

4a) Of the above claim(s) *17-34* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *35-59* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 December 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on December 18, 2002 has been entered.

Response to Amendment

2. in response to the amendment received December 18, 2002:

   a. Claims 17-59 are pending with claims 17-34 withdrawn from consideration due to a prior restriction requirement;

   b. The drawing objection of paragraph 7 in the Office Action mailed June 14, 2001, is withdrawn;

   c. The claim objections have been withdrawn;

   d. The 112 rejections have been withdrawn;

   e. The prior art rejections stand.

Election/Restrictions

2. This application contains claims 17-34 drawn to an invention nonelected with traverse in Paper No. 7. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Drawings

3. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on December 23, 2002 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 35, 37, 42, 43 and 57-58 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by DE 41 04 592 A1 (DE '592).

See page 6 of the previous office action for the marked-up copy of Fig. 1, incorporated herein.

Fig. 1 discloses a sputtering chamber 3 comprising at least one sputtering source 6 with a new sputter surface 10 at least approximately symmetrical with respect to a first axis (Tx) (see marked-up copy in the previous office action), the axis being perpendicular to the sputter surface 10, substrate carrier 3 which is arranged to be driveably rotatable about a second axis (Sx), wherein the first and second axes are oblique with respect to one another and said sputtering source is a magnetron sputtering source with at least one closed-loop, tunnel-shaped magnetic field pattern 11 around said first axis with constant field polarity as viewed in a direction along said closed loop (as applied to claim 35).

The first and second axes are virtual and infinite along the plane which defines each respective axis. Since the axes are oblique, they will intersect at some point (red X in marked up Fig. 1 above as applied to claim 37).

The first and second axes have a smallest mutual spacing situated on a surface of workpiece 18 (as applied to claim 42).

The substrate carrier 13 is located within chamber 3 at least approximately horizontally (HP in marked up Fig. 1 above as applied to claim 43).

The substrate carrier surface and new sputter surface bound a process space as shown in Fig. 1 (yellow highlight as applied to claim 57).

With respect to the method: DE '592 discloses: introducing a workpiece 4 into a sputtering chamber 3, rotating the workpiece about a rotational axis, providing a sputtering source 6 with a sputtering surface 10 having a central axis oblique with respect to the rotational axis, sputter coating a workpiece by a source thereby providing

at least one closed-loop, tunnel shaped magnetic field pattern 11 with a constant field-polarity as viewed in a direction along said closed loop (as applied to claim 58).

Response to Arguments

6. Applicant's arguments filed December 18, 2002 have been fully considered but they are not persuasive.

Applicant argues that DE '592 does not teach of at least one closed-loop, tunnel-shaped magnetic field pattern around the first axis, which magnetic field has a constant field polarity taken in a direction along the closed loop.

Applicant states that it could well be that DE '592 may not have this magnetic field configuration. In view of the magnetic field lines 11 shown in Fig. 1, it is unclear how these magnetic field lines are not closed-loop (as they appear to be), tunnel-shaped (as would be inherent to the three dimensional target), and of constant field polarity (as shown by the uniform magnetic field lines 11) in a direction along the closed loop. Thus it would appear that DE '592 still anticipates this magnetic field arrangement, contrary to Applicant's position.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 36, 51-54 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over DE '592 in view of U.S. patent No. 6,071,390 (Nagaishi) or 5,439,877 (Face).

The teachings of DE '592 have been discussed above and are incorporated herein.

The differences not yet discussed are: using a symmetrical target source (claims 36 and 51); where in the ratio of the diameter of the substrate to the diameter of the target is in a range from 0.5 to 2.4 (claim 51) and further in a range from 1 to 2.4 (claim 52), wherein the substrate has a diameter ranging from 50mm to 400mm (claim 53), further from 50mm to 300mm (claim 54); or of the substrate explicitly being a wafer (claim 58).

With respect to claims 36, 51 and 52

It is known to form superconductive films on circular substrates from circular targets (both being symmetrical). Nagaishi is drawn to depositing superconductive films such as Y-Ba-Cu-O. A single crystalline Si wafer having a size of 76 mm in diameter and 0.4 mm in thickness was used for substrate 6. A Y-$Ba_2Cu_3O_{7-x}$ disc having a size of 76 mm in diameter and 5 mm in thickness was used for target 5 (col. 12, ll. 49-55). The target diameter and substrate diameter are the same (as applied to claims 51 and 52) and the target having a diameter is a symmetrical source (claim 36).

Face also teaches that using 76 mm targets and substrates in sputtering systems for forming superconductive films represent conventional sizes for both components and

readily available for use in sputtering systems (col. 8, ll. 5-16 as applied to claims 36, 51-52 and 58).

The motivation for providing a target and substrate diameter relationship within the ranges recited in the instant claim is that it optimizes the coating profile on the substrate and provides a better coating of the entire substrate.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of DE '592 by providing a target and substrate diameter relationship of 1:1 since it would have optimized the coating profile on the substrate and provides a better coating of the entire substrate. Selection of the shape is a matter of preference for the intended use of the finished product. Selection of the shape of the target then being a matter of choice.

With respect to the size of the substrate (claims 53 and 54).

The diameter of the substrate is 76 mm in both the teachings of Face and Nagaishi (as discussed above as applied to claims 53 and 54).

Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such ranges is critical. In re Boesche , 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

It would have been an obvious matter of design choice to change the size of the substrate since such a modification would have involved a mere change in the size of

the substrate. A change in the size is generally considered as being within the level of ordinary skill in the art. *In re Rose,* 105 USPQ 237 (CCPA 1955).

9. Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over DE '592 in view of either Face or Naimichi as applied to claims 36, 51-54 and 58 and in further view of U.S. patent No. 5,820,682 (Sung).

The difference not yet discussed is of the substrate having a diameter of 64 mm, 120 mm, 160mm or 240 mm.

DE '592 is drawn to methods of fabricating superconductive devices. Sung teaches that 16 cm (160 mm) substrate diameters is a known size for a substrate dimension used in fabricating superconductors (col. 1, ll. 60-62).

Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such ranges is critical. In re Boesche , 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

It would have been an obvious matter of design choice to change the size of the substrate since such a modification would have involved a mere change in the size of the substrate. A change in the size is generally considered as being within the level of ordinary skill in the art. *In re Rose,* 105 USPQ 237 (CCPA 1955).

10. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over DE '592 in view of JP 2 141568 (JP '568).

The teachings of DE '592 have been discussed above and are incorporated herein.

The difference not yet discussed is a projection of said new sputter surface onto a plane perpendicular to said first axis is larger than a projection surface of the substrate to be sputter coated onto said plane.

JP '568 is drawn to off-axis sputtering of superconductive films (abstract and Fig.1). By configuring the substrate and target wherein the projection of the sputter surface in a plane perpendicular to the first axis is larger than a projection surface of the substrate to be sputter coated onto said plane prevents resputtering of the thin film from occurring (abstract).

The motivation for providing a projection of said new sputter surface onto a plane perpendicular to said first axis is larger than a projection surface of the substrate to be sputter coated onto said plane in an oblique sputtering system is to prevent resputtering of the thin film during deposition.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of DE '592 by providing a projection of said new sputter surface onto a plane perpendicular to said first axis is larger than a projection surface of the substrate to be sputter coated onto said plane in an oblique sputtering system as shown by JP '568 since it would have prevented resputtering of the thin film during deposition.

11. Claim 56 is rejected under 35 U.S.C. 103(a) as being unpatentable over DE '592 in view of either Tateshi or Moslehi.

The teachings of DE '592 have been discussed above and are incorporated herein.

The difference not yet discussed is of moving the substrate linearly in a direction parallel to the substrate carrier axis (claim 56).

Tateshi discloses a magnetron sputtering apparatus wherein the substrate support moves laterally. The lateral movement means allows for positioning a substrate such that it can be transferred to and from the processing chamber while also providing close target to substrate processing during deposition (see Fig. 7). It is well known in the art to position a gate for introducing the substrate to the processing chamber, near the bottom of the chamber and thereafter raise the substrate and substrate platen to an upper position closer to the target.

Additionally use of an actuator to move the substrate in a vertical position to achieve a predetermined deposition distance between the substrate and the tantalum target in order to establish the optimal deposition uniformity and material properties (Moslehi, col. 11 lines 29-35).

The motivation for providing means for moving the substrate carrier in this fashion is to raise the substrate from a substrate chamber insertion position to a wafer film deposition position. It is also known that providing means to move the substrate vertically relative to the deposition source to establish optimal deposition uniformity and material properties.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of DE '592 by moving the substrate carrier in this fashion since it would provided means for a wafer inserted at the base of the chamber sidewall to be moved in close proximity to the target and further

such movement would have optimized deposition uniformity and material properties of the thin film.

12. Claims 38-41 rejected under 35 U.S.C. 103(a) as being unpatentable over DE '592 in view of Yamanishi.

The teachings of DE '592 have been discussed above and are incorporated herein.

The differences not yet discussed are of setting the angle of the magnetron relative to the substrate carrier surface to be within the ranges set forth in claims 38-41.

DE '592 does teach of positioning the magnetron at an angle to the substrate carrier surface (Fig. 1). The angle can be set to a value within the range from 0° to 90° (see col. 3, ll. 1-5).

The preferred angle of the invention of Yamanishi is between 30° and 60° (col. 3. ll. 21-25) to provide uniform thickness of the film on the substrate (col. 8, ll. 25-28 as applied to claims 38-41). And by one example the actual angle is 45° (col. 7, ll. 17-24). Thus it would have been expected that the same range be applied in the prior art, which shows identical positional relationship.

The motivation for positioning the magnetrons relative to the substrate within the range of 30° to 60° is to provide uniform thickness of the film on the substrate.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of the DE '592 by positioning the magnetrons at an angle from 30° to 60° relative to the substrate carrier since it would have provided uniform thickness of the film on the substrate.

Response to Arguments

13. Applicant's arguments filed December 18, 2002 have been fully considered but they are not persuasive.

See arguments in item 6 above, incorporated herein. Applicant does not appear to present further arguments to the 103 rejections set forth above apart from those arguments discussed in item 6 above.

Claim Rejections - 35 USC § 103

14. Claims 35-38, 42-44, 46-50 and 56-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2 141 568 A (JP '568) in view of Yamanishi.

See page 15 of the previous office action for the marked-up copy of Fig. 1, incorporated herein.

Fig. 1 discloses a sputtering system comprising an inherent sputtering chamber, at least one sputtering source 1 with a new sputter surface at least approximately symmetrical with respect to a first axis (Tx, see marked-up drawing in the previous office action), the axis being perpendicular to the sputter surface, substrate carrier 4 which is arranged about a second axis (Ts, see marked-up drawing in the previous office action), wherein the first and second axes are oblique with respect to one another and said sputtering source is a magnetron sputtering source with at least one closed-loop, tunnel-shaped magnetic field pattern around said first axis with constant field

polarity as viewed in a direction along said closed loop. The field lines drawn in the marked up drawing below by Examiner on the basis that such field lines are inherent due to the configuration of the permanent magnet polarities and evident from the erosion profile 3 in the target surface (as applied to claim 35).

The target is rotationally symmetrical about its axis (as applied to claim 36).

When angled as taught by JP '568, the first and second axes, being oblique and infinite will intersect at least approximately (red X in the marked-up drawing as applied to claim 37).

The angle minimum is 60° (abstract as applied to claim 38).

The first and second axes have a smallest mutual spacing D (see marked up drawing) situated at least approximately on a surface which is to be sputter coated of a substrate (see marked up figure as applied to claim 42).

As shown in Fig.1 rotation of the substrate holder is horizontal with respect to the bottom support surface for the rotating substrate holder (HP plane in drawing as applied to claim 43).

A projection of said new sputter surface onto a plane perpendicular to said first axis (denoted as TPS in the marked-up figure) is larger than a projection surface of the substrate (SPS) to be coated onto said plane (as applied to clam 44).

There is a circular erosion ditch 3 caused by the magnetic field generated by the permanent magnet relationship shown in Fig. 1, the radius (rTr) is about 1/3 of the length D and is within the range of $\frac{1}{4} \leq rTr \leq 2/3$ (as shown in the marked up drawing and applied to claim 46).

The target is substantially rotationally symmetrical about its central axis and has an inherent diameter (ϕT). The diameter of the target and length D are about the same (as applied to claim 47).

The substrate has a diameter (ϕs) and is much smaller than the length D. Therefore with a substrate diameter less than length D, the ratio of (ϕs)/D will be less than 1 (and less than 1.8 as applied to claim 49).

The locus of the smallest mutual spacing is on a plane defined by a surface of the substrate to be coated (see L in marked up figure as applied to claim 50).

The substrate carrier is linearly drivingly displaceable in a direction of the second axis (Fig .1 as applied to claim 56).

The target and substrate face each other and bound a process space on the two sides thereof (yellow highlight Fig. 1 as applied to claim 57).

With respect to the method: JP '568 discloses: introducing a workpiece 5 into a sputtering chamber, providing a sputtering source 1 with a sputtering surface having a central axis oblique with respect to the rotational axis, sputter coating a workpiece by a source thereby providing at least one closed-loop, tunnel-shaped magnetic field, inherent from the configuration of the magnet polarities and evident from the configuration of the erosion profile with a constant field polarity as viewed in a direction along said closed loop (as applied to claim 58).

The differences between the instant claims and JP '568 are that JP '568 does not disclose that the substrate carrier is drivingly rotatable about a second axis (claims 35 and 58) or of the diameter of the target being about 1.2 D (claim 48).

With respect to rotating the substrate carrier (claims 35 and 58):

Yamanishi employs a rotating substrate holder (see Fig. 2, rotational means 90 and Fig. 7, substrate carrier 17 rotated about its central axis). When employing magnetron sources inclined at an angle relative to the substrate, if the substrate and substrate carrier is made to revolve, the thickness uniformity and quality uniformity of the film formed on the substrate are further improved (col. 7, ll. 20-24 as applied to claims 35 and 58).

The motivation for rotating the substrate about its axis is that the thickness uniformity and quality uniformity of the film formed on the substrate are further improved

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '568 by rotating the substrate carrier and substrate about the carrier axis as taught in the invention of Yamanishi since it would have further improved the uniformity and quality uniformity of the film formed on the substrate.

With respect to the diameter of the target being approx. 1.2 D (claim 48):

JP '568 teaches that the substrate holder 4 can be moved towards and away from the target. As the sputtering target 1 erodes, local erosions spots form in regions

3. This causes a variance in the sputtering flux from the target onto the substrate. To compensate for this variance, JP '568 moves the substrate along the central axis of the substrate carrier. Doing so varies the distance D (locus of smallest mutual spacing). Upon moving the substrate carrier closer to the target to improve deposition uniformity, distance D will increase, thereby increasing the ratio of the target diameter relative to the distance D. Given that the ratio from the figures teaches of an approximate 1:1 ratio, decreasing the distance D to improve uniformity of the coating on the substrate, will increase the ratio, rendering the approximate ratio of claim 48 a resulting relationship relative to the change in distance D for improving the substrate coating.

The motivation for decreasing the distance D between the target and substrate is to enhance the deposition profile. By doing so, the ratio of the target diameter (a static value) relative to the distance D will increase from about 1 and render an approximate value of 1.2 an obvious result.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '568 by decreasing the distance D since it would have compensated for the variance in sputtering from the local erosions formed on the target. This would have resulted in an increase in the ratio of the target diameter relative to the distance D. Optimizing this distance would have rendered an approximate value of 1.2 an obvious result.

Response to Arguments

15. Applicant's arguments filed December 18, 2002 have been fully considered but they are not persuasive.

Applicant argues that JP '568 does not teach of a closed-loop, tunnel-shaped magnetic field pattern.

The Examiner respectfully disagrees. The erosion profile shown in Fig. 1 and the arrangement of the permanent magnets therein would provide for an inherent magnetic field configuration which is closed-loop and tunnel-shaped around the target axis and since the magnets are permanent magnets, the field polarity will be constant as viewed in a direction along said closed loop.

Applicant further argues that JP '568 does not teach of rotating the substrate.

As discussed above, Yamanishi employs a rotating substrate holder (see Fig. 2, rotational means 90 and Fig. 7, substrate carrier 17 rotated about its central axis). When employing magnetron sources inclined at an angle relative to the substrate, if the substrate and substrate carrier is made to revolve, the thickness uniformity and quality uniformity of the film formed on the substrate are further improved (col. 7, ll. 20-24 as applied to claims 35 and 58).

The motivation for rotating the substrate about its axis is that the thickness uniformity and quality uniformity of the film formed on the substrate are further improved

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '568 by rotating the substrate carrier and substrate about the carrier axis as taught in the invention of

Yamanishi since it would have further improved the uniformity and quality uniformity of the film formed on the substrate.

Claim Rejections - 35 USC § 103

16. Claims 35, 37-43, 45 and 57-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art of U.S. patent No. 5,626,727 (Yamanishi) in view of the description of the invention of Yamanishi.

See page 20 of the previous office action for the marked-up copy of Fig. 12, incorporated herein.

Fig. 12 shows a prior art configuration which read on the following claims: a sputtering chamber, not shown in Fig. 12 but inherent to a sputtering system, see Figs. 7 and 11 which show placement of sputtering equipment in a sputtering chamber comprising at least one sputtering surface symmetrical with respect to a central axis (central axis Tx as shown in the marked-up drawing in the previous office action) the axis perpendicular on said new sputtering surface, a substrate carrier (carrying substrate 18) having a second axis (Sx, see marked-up drawing in the previous office action) the two axes are oblique with respect to one another, and said sputtering source is a magnetron sputtering source wherein the magnet polarities are arranged such that they will generate a closed-loop, tunnel-shaped magnetic field around the first axis with constant field polarity as viewed in a direction along said closed loop (Fig. 10). The field lines have been drawn in by the Examiner (dotted lines) given the location of each pole

in the target, a closed-loop, tunnel-shaped magnetic field will result (see also col. 1, ll. 58-60 as applied to claim 35).

The first and second axes are virtual and infinite along the plane which defines each respective axis. Since the axes are oblique, they will intersect at some point (see red X in marked up Fig. 12 below as applied to claim 37).

The first and second axes have a smallest mutual D spacing situated on a surface of workpiece 18 (as applied to claim 42).

The substrate carrier is located approximately horizontally in the chamber (HP), note though that the reference for the horizontal plane is undefined by the claim and can be horizontal relative to any plane in the chamber (see Figs. 2, 7, and 11 all which show the substrate carrier horizontal relative to a chamber wall or top or bottom as applied to claim 43).

Two sputtering surfaces 1 having individual power sources 11 are provided in the system shown in Fig. 12 (as applied to claim 45).

The surface of the substrate 18 and its carrier and the surface of the sputter surfaces 1 bound a process space on two sides (yellow highlight Fig. 12 as applied to claim 57).

The prior art employs a method for coating workpiece 18 comprising: introducing workpiece 18 into the sputtering chamber, providing a sputtering source 1 with a sputtering surface and having a central axis which is oblique with respect to the axis of the substrate carrier, sputter coating the workpiece by the source where the source has

a closed-loop, tunnel-shaped magnetic field with a constant field-polarity as viewed in a direction along said closed loop (Figs. 10 and 12 as applied to claim 58).

The differences between the instant claims and the prior art of Yamanishi are that the prior art of Yamanishi does not explicitly disclose rotating the substrate about its axis (claims 35 and 58) or explicitly of the range of angles within which the magnetrons are positioned relative to the substrate carrier (claims 38-41).

With respect to rotating the substrate about its axis (claims 35 and 58):

The prior art of Yamanishi does not explicitly teach of rotating the substrate carrier and substrate about the carrier axis. The invention of Yamanishi does employ such means (see Fig. 2, rotational means 90 and Fig. 7, substrate carrier 17 rotated about its central axis). When employing magnetron sources inclined at an angle relative to the substrate, if the substrate and substrate carrier is made to revolve, the thickness uniformity and quality uniformity of the film formed on the substrate are further improved (col. 7, ll. 20-24 as applied to claims 35 and 58).

The motivation for rotating the substrate about its axis is that the thickness uniformity and quality uniformity of the film formed on the substrate are further improved

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of the prior art of Yamanishi by rotating the substrate carrier and substrate about the carrier axis as taught in the invention of Yamanishi since it would have further improved the uniformity and quality uniformity of the film formed on the substrate.

With respect to claims 38-41 and the angular relationships set forth therein:

The magnetrons are shown to be at an angle relative to the substrate carrier and although the prior art disclosure of Yamanishi does not explicitly disclose of the range, from a comparison of the position of the magnetrons relative to the substrate as shown in Fig. 12 to that of (Figs. 2 and 7) it would appear that the range of angles for positioning the magnetron sources would have been identical. The preferred angle of the invention of Yamanishi is between 30° and 60° (col. 3. ll. 21-25) to provide uniform thickness of the film on the substrate (col. 8, ll. 25-28 as applied to claims 38-41). And by one example the actual angle is 45° (col. 7, ll. 17-24). Thus it would have been expected that the same range be applied in the prior art, which shows identical positional relationship.

In the unlikely event that Applicant would argue the inherency of the prior art of Yamanishi showing the claimed ranges, such would have clearly been obvious given the teachings of the invention of Yamanishi as discussed above.

The motivation for positioning the magnetrons relative to the substrate within the range of 30° to 60° is to provide uniform thickness of the film on the substrate.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of the prior art of Yamanishi by positioning the magnetrons at an angle from 30° to 60° relative to the substrate carrier since it would have provided uniform thickness of the film on the substrate.

Response to Arguments

17. Applicant's arguments filed December 18, 2002 have been fully considered but they are not persuasive.

Applicant's arguments do not appear to agree with the manner in which the Yamanishi reference is applied.

As set forth above, and in the previous office action, the rejection is based on the prior art of Yamanishi (see the opening statement of the Yamanishi reference rejection above). As admitted by the Applicant, the prior art magnetic configuration of Yamanishi (Fig. 10) is a closed-loop, tunnel-shaped magnetic field. Therefore it is clear that the prior art teachings in the Yamanishi reference teach of the instant claimed magnetic field arrangement.

The fact is that while Yamanishi may have been drawn to a magnetic arrangement which differs from a closed-loop, tunnel-shaped magnetic field there is a clear teaching that such a configuration is known in the art as shown by the prior art disclosure and teachings within the Yamanishi reference.

Applicant's attention is drawn to MPEP § 2123.

"The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain." In re Heck, 699 F.2d 1331, 1332-33, 216 USPQ 1038, 1039 (Fed. Cir. 1983) (quoting In re Lemelson, 397 F.2d 1006, 1009, 158 USPQ 275, 277 (CCPA 1968)). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including

nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). See also Celeritas Technologies Ltd. v. Rockwell International Corp., 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998). Disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 440 F.2d 442, 169 USPQ 423 (CCPA 1971). "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994).

In addition see MPEP § 2141.02 (prior art must be considered in its entirety, including disclosures that teach away from the claims) and MPEP § 2143.01 (proposed modification cannot render the prior art unsatisfactory for its intended purpose or change the principle of operation of a reference).

Therefore the instant claims are held to be obvious over the disclosed prior art magnetron sputtering system and method in the Yamanishi reference.

Conclusion

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregg Cantelmo whose telephone number is (703) 305-0635. The examiner can normally be reached on Monday through Thursday from 8:00 a.m. to 5:30 p.m. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan, can be reached on (703) 308-2383. FAX

communications should be sent to the appropriate FAX number: (703) 872-9311 for After Final Responses only; (703) 872-9310 for all other responses. FAXES received after 4 p.m. will not be processed until the following business day. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Gregg Cantelmo
Patent Examiner
Art Unit 1745

gc

Gregg Cantelmo

January 27, 2003 1